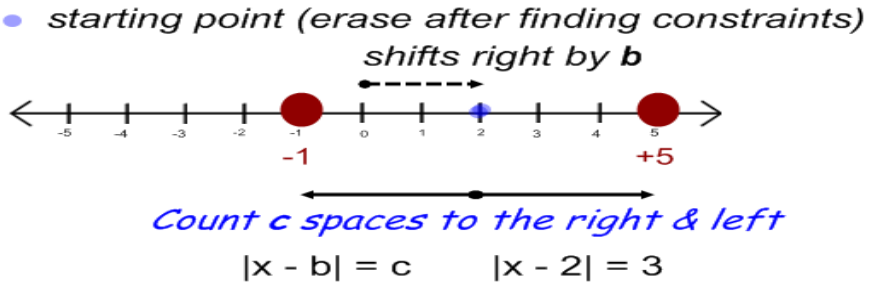
The **absolute value** of a number x is

- the distance between zero and positive x, (+x)
- the distance between zero and negative x, (-x)

Absolute Value Equations

Graphing Method
Equation Method

Shifting to the Right of Zero



$|x - b| = c$ $|x - 2| = 3$

Proceedure for Drawing the Number Line

1. Draw a number line with zero in the middle.
2. Shift **b** spaces from zero to the **right** & temporarily mark it.
3. The value of c informs us how many spaces we move in both directions.
4. Move **c** spaces to the left & create a dot (includes) or circle (excludes).
5. Move **c** spaces to the right & create a dot of circle.

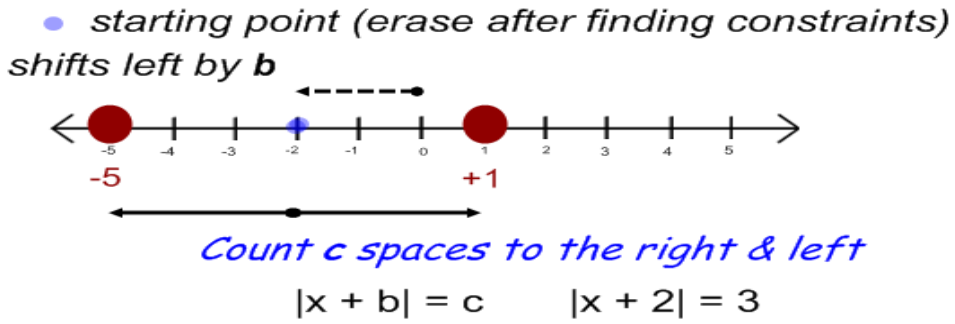
Proceedure for Solving Using the Equation Method

1. Create two columns & label Case 1 (negative) & Case 2 (Positive)
2. Rewrite the absolute value equations as an equations for each case.
3. In Case 1, change of sign of the right numerical term, -make it a negative.
4. Solve for x in Case 1.
5. Solve for x in Case 2.
6. Does the solutions matcht the drawing?
7. Check you solutions through substitution.

Equation Method $\lvert x-2\rvert=3$	**Example 2:** $\lvert 5x-1\rvert=4$
Formula: $\lvert x-b\rvert=c$ $\lvert x-2\rvert=3$ Solve for x. **Case 1** **Solution** **Case 2** The solution is Negative Positive **(-)** **(+)** $x-2=-3$ $x-2=+3$ $x=-1$ $x=+5$ Check it by substitution $\lvert x-2\rvert=3$ $\lvert(-1)-2\rvert=3$ True $\lvert(5)-2\rvert=3$ True	**(-)** **Solution** **(+)** Case 1 Case 2 $5x-1=-4$ $5x-1=4$ $+1 \quad +1$ $+1 \quad +1$ $\frac{5x}{5}=\frac{-3}{5}$ $\frac{5x}{5}=\frac{5}{5}$ $x=\frac{-3}{5}=-0.60$ $x=+1$ Check it by substitution $\left\lvert 5\left(\frac{-3}{5}\right)-1\right\rvert=4$ True $\lvert 5(1)-1\rvert=4$ True

Absolute Value Equations
Graphing Method
Equation Method

Shifting to the Left of Zero



Proceedure for
Drawing the Number Line

1. Draw a number line with zero in the middle.
2. Shift **b** spaces from zero to the **left** & temporarily mark it.
3. The value of c informs us how many spaces we move in both directions.
4. Move **c** spaces to the left & create a dot (includes) or circle (excludes).
5. Move **c** spaces to the right & create a dot of circle.

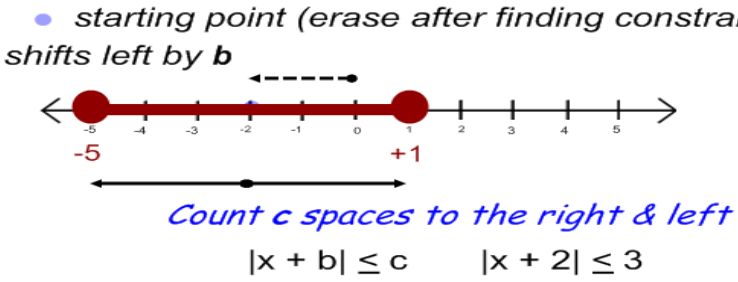
Proceedure for Solving Using the Equation Method

1. Create two columns & label Case 1 (negative) & Case 2 (Positive)
2. Rewrite the absolute value equations as an equations for each case.
3. In Case 1, change of sign of the right numerical term, -make it a negative.
4. Solve for x in Case 1.
5. Solve for x in Case 2.
6. Does the solutions matcht the drawing?
7. Check you solutions through substitution.

Equation Method	Example 2: $\lvert 5x+1\rvert=4$
Formula: $\lvert x+b\rvert=c$ $\lvert x+2\rvert=3$ Solve for x. **Case 1** **Solution** **Case 2** The solution is Negative Positive **(-)** **(+)** $x+2=-3$ $x+2=+3$ $x=-5$ $x=1$ Check it by substitution $\lvert x+2\rvert=3$ $\lvert(-5)+2\rvert=3$ True $\lvert(1)+2\rvert=3$ True	**(-)** **Solution** **(+)** Case 1 Case 2 $5x-1=-4$ $5x-1=4$ $+1\quad+1$ $+1\quad+1$ $\frac{5x}{5}=\frac{-3}{5}$ $\frac{5x}{5}=\frac{5}{5}$ $x=-1$ $x=\frac{3}{5}=0.60$ Check it by substitution $\lvert 5(-1)+1\rvert=4$ True $\left\lvert 5(\frac{3}{5})+1\right\rvert=4$ True

Absolute Value Inequalities

*Follow the same **shifting patterns** as absolute value equations*



Proceedure for Drawing the Number Line

1. Draw a number line with zero in the middle.
2. Shift **b** spaces from zero to the **left or right** & temporarily mark it.
3. The value of c informs us how many spaces we move in both directions.
4. Move **c** spaces to the left & create a dot (includes) or circle (excludes).
5. Move **c** spaces to the right & create a dot of circle.
6. Point the arrows in correct direction.

Proceedure for Solving Using the Equation Method

1. Create two columns & label Case 1 (negative) & Case 2 (Positive)
2. Rewrite the absolute value equations as an equations for each case.
3. In Case 1, change of sign of the left expression, -make it negative.
4. Solve for x in Case 1.
   a) Multiplying or dividing by a negative changes the direction of the inequality symbol.
5. Solve for x in Case 2.
6. Does the solutions matcht the drawing?
7. Check you solutions through substitution.

Case 1 Solution **Case 2**

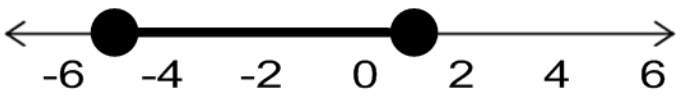
Negative **(-)**

$$-(x+2)\le 3$$
$$-(x+2)\cdot(-1)\le 3\cdot(-1)$$
$$x+2\ge -3$$
$$-2 \quad -2$$
$$x\ge -5$$

Positive **(+)**

$$x+2\le +3$$
$$-2 \quad -2$$
$$x\le 1$$

$x\le 1$



Check it by substitution

$$|x+2|\le 3$$

$|(-5)+2|\le 3$ True $|(1)+2|\le 3$ True

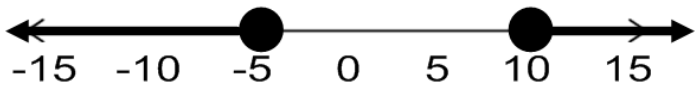
Example 2: $|2x-5|\ge 15$

(-)

$$-(2x-5)\ge 15$$
$$-(2x-5)\cdot(-1)\ge 15\cdot(-1)$$
$$2x-5\le -15$$
$$+5 \quad +5$$
$$2x \le -10$$
$$\frac{2x}{2}\le\frac{-10}{2}$$
$$x\le -5$$

(+)

$$2x-5\ge 15$$
$$+5 \quad +5$$
$$2x\ge 20$$
$$x\ge 10$$



Notice, the original absolute value inequality says" greater than or equal to".